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(54) Fire protection sprinklers

(57) A fire protection sprinkler 4 comprises a body member 5 having a longitudinal axis X-X; a water supply bore extending through the body member 5, co-axial with the longitudinal axis X-X and terminating at a water discharge orifice; support means 15 extending from the body member 5 to carry a deflector 18 at a location spaced from the discharge orifice; and the deflector 18 secured to the support means 15 at an angle greater than 90° and less than 180° with respect to the longitudinal axis X-X, such that an active surface 19 of the deflector 18, upon activation of the sprinkler 4, is struck by a water column emerging from the discharge orifice. The invention also includes a fire protection sprinkler installation comprising a sprinkler as defined above mounted at an elevated location in or on a structure 1 having a vertical face in such a disposition that the sprinkler 4 is generally downwardly or upwardly directed, at an angle less than 90° and greater than 0° with respect to the vertical face of the structure 1.

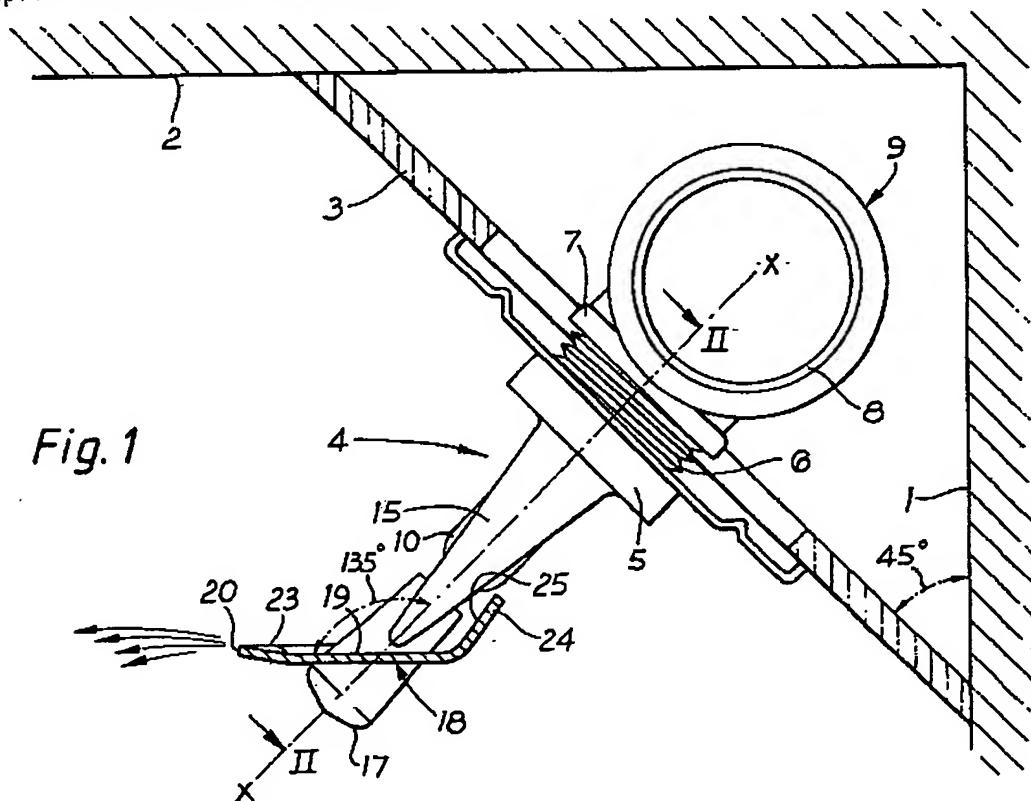
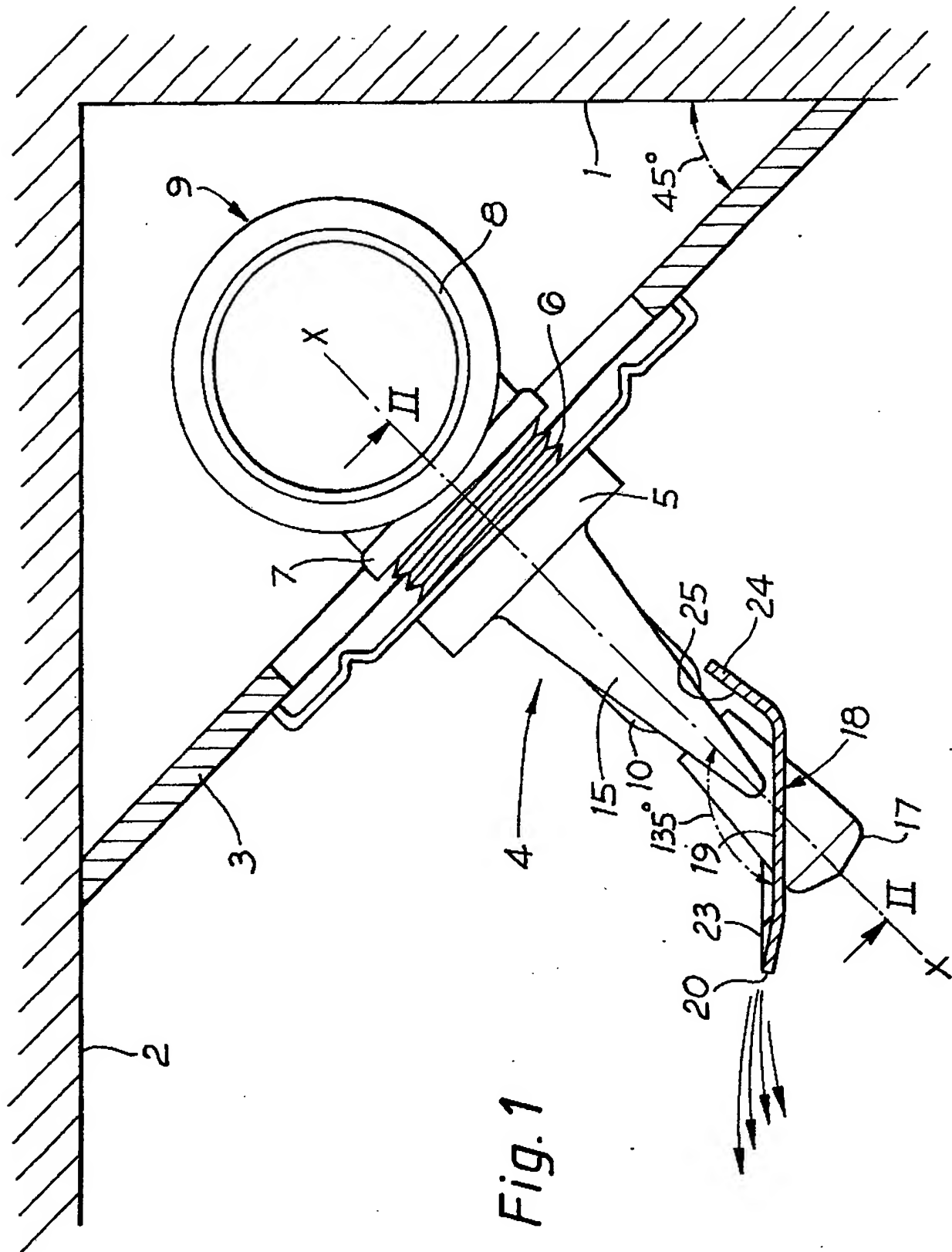
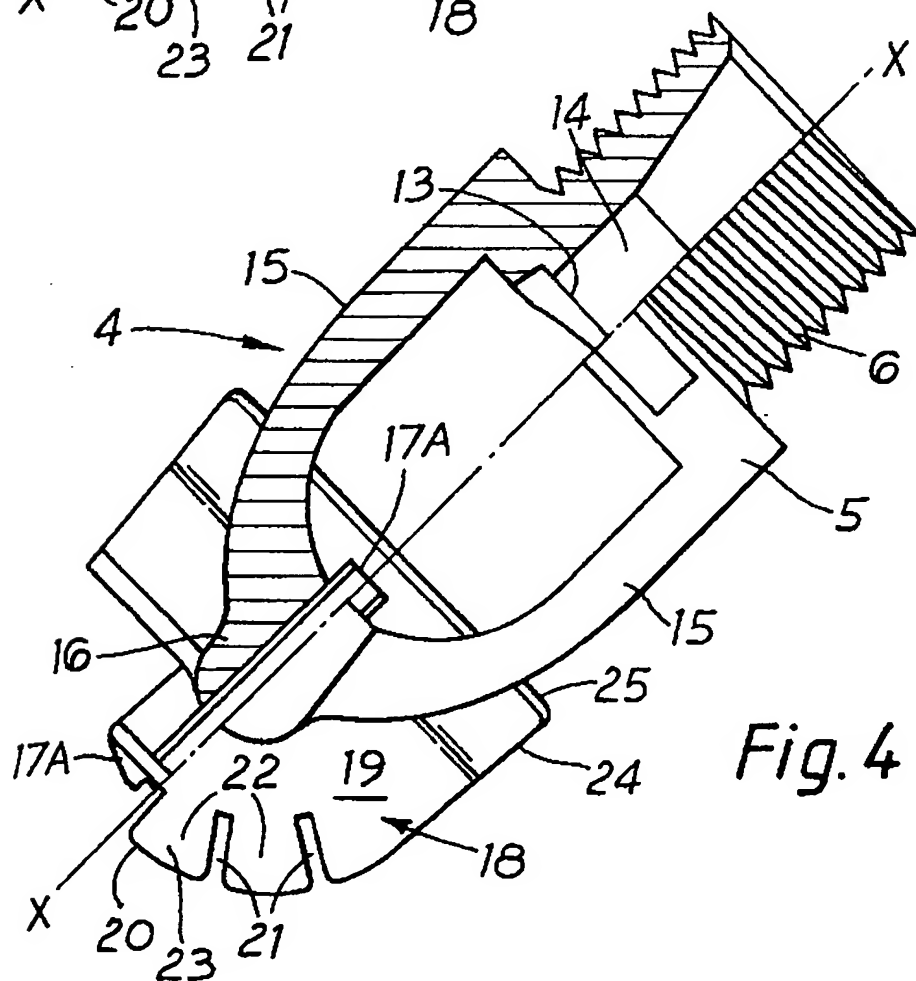
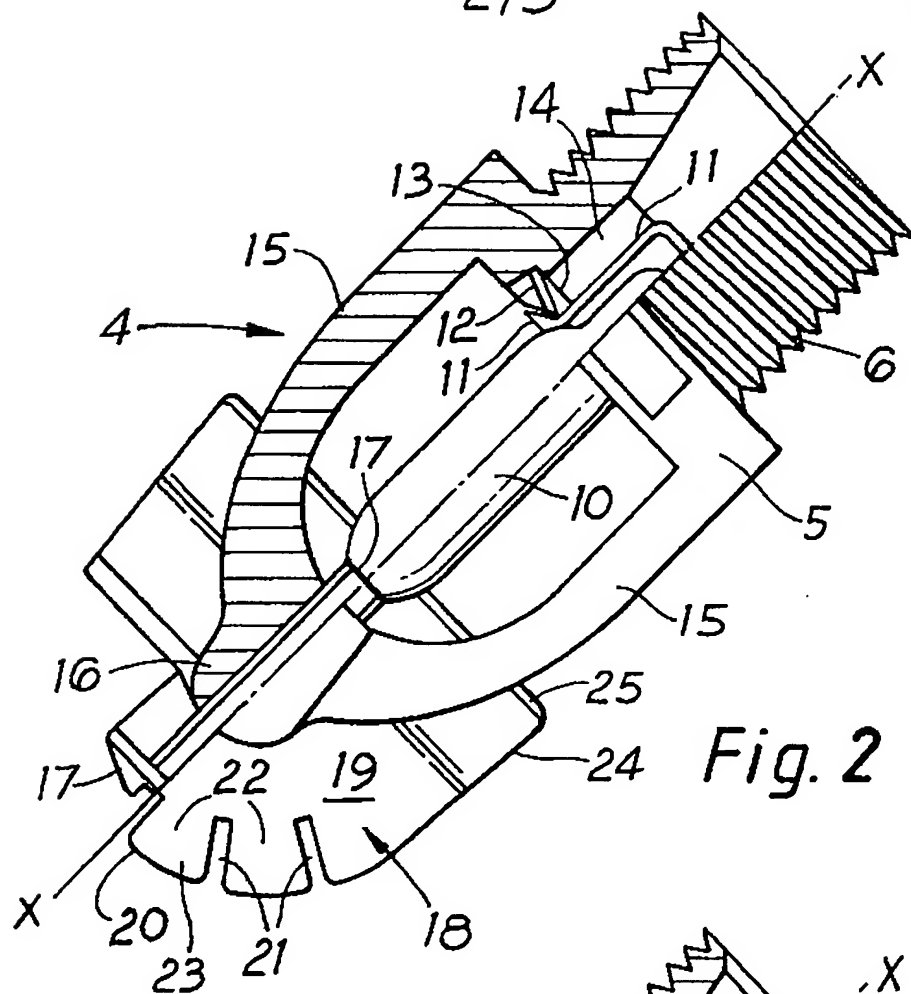
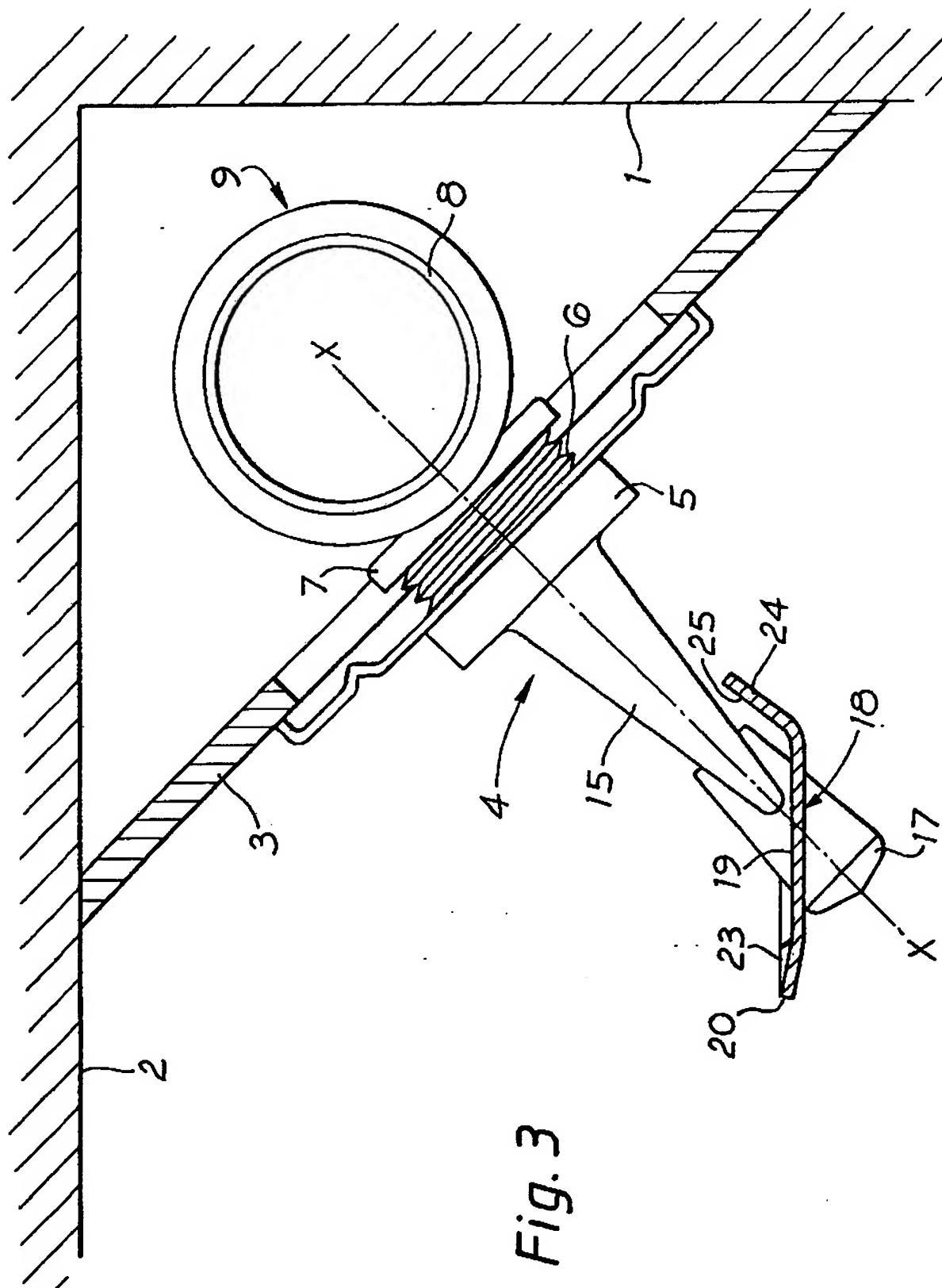


Fig. 1







FIRE PROTECTION SPRINKLERS

This invention relates to fire protection sprinklers, intended to be mounted at an elevated location, e.g. in an hotel, department store or other enclosure, to spray water into the enclosure in a pattern determined by the configuration of a plate-like deflector onto which a water column is projected, when the sprinkler is activated. Activation could be effected locally e.g., by a temperature sensitive frangible bulb or fusible link, or remotely e.g. under the control of a temperature and/or smoke detector and/or infra red flame detector.

Fire protection sprinklers have in the past been installed vertically in either pendent or upright position; and an appropriate deflector e.g. spray; conventional discharge; or sidewall; is fitted to provide a particular spray pattern to ensure coverage of the area involved. For a given water pressure and flow rate, deflectors have of course a maximum area of coverage and sprinklers are frequently used in combination to utilise overlapping spray patterns. However, for all applications, different deflectors have been fitted to industry-standard sprinklers at 90° to the water column or a combination of 90° and 180° , and these include so-called pendent deflectors; upright deflectors; conventional upright or pendent deflectors; sidewall upright or pendent defl ctor; and horizontal extended spray sidewall, the basic function in all cases being that, upon activation, the water column strikes the deflector "head on" and is converted into a uniformly distributed pattern over a given area.

To distribute water over an extended area, in contrast

to the area covered by a conventional umbrella pattern spray, horizontally installed sidewall sprinklers have been developed. As the water is projected initially horizontally, such sprinklers require a complex deflector to produce the
5 necessary water distribution. Such deflectors are pressed and blanked from sheet metal but are inherently weak and hence prone to damage or permanent deformation in transit and/or installation, and it will be appreciated that even an
10 apparently insignificant deformation of a deflector from its as-manufactured disposition, frequently results in the sprinkler being incapable of providing the intended area of coverage.

According to a first aspect of the present invention, there is provided a fire protection sprinkler comprising:-

- 15 (a) a body member having a longitudinal axis;
- (b) a water supply bore extending through the body member, co-axial with the longitudinal axis thereof and terminating at a water discharge orifice;
- 20 (c) support means extending from the body member to carry a deflector at a location spaced from the discharge orifice; and
- (d) the deflector secured to the support means at an angle greater than 90° and less than 180° with
25 respect to the longitudinal axis of the body member, such that an active surface of the deflector, upon activation of the sprinkler, is struck by a water column emerging from the discharge orifice.

According to a second aspect of the present invention there is provided a fire protection sprinkler installation comprising a sprinkler as defined above mounted at an elevated location in or on a structure having a vertical face in such a disposition that the sprinkler is generally downwardly or upwardly directed, at an angle less than 90° and greater than 0° with respect to the vertical face of the structure.

The structure could for instance be a wall, if the protection of a room were involved, or a gallery or walkway edge if the protection of an atrium were involved.

The sprinkler in accordance with the first and second aspects of the invention produces an extended spray and maintains adequate density of water application over the extended area together with wall wetting at the increased distance.

The deflector is preferably plate-like and is inclined to the longitudinal axis of the sprinkler at such an angle that, upon activation of the sprinkler, the water column emitted from the water discharge orifice and impinging on the deflector is deflected through an angle of less than 90° . A preferred angle is 45° , so that there is an included angle of 135° between the emerging column of water and the active surface. It is desirable of course that the area of the active surface of the deflector is greater than the cross-sectional area of the water discharge orifice.

The deflector may be attached e.g. by a screw, to the body member of the sprinkler, or formed as an integral element of the body member. The deflector preferably has a front edge over which the deflected water spray or jet flows upon

activation of the sprinkler and an upwardly-turned lip at a rear edge of the deflector opposite the said front edge to restrain water flow or spray rearwardly of the deflector. The sprinkler is preferably die cast in brass or other alloy with the deflector not vulnerable to impact deformation when subjected to impact forces below 220N (Test 7.17 F.O.C. Requirements and testing methods for Automatic Sprinklers.)

The sprinkler can be activated locally, by being fitted with a heat sensitive element of any type, of any time constant or R.T.I. Alternatively, the sprinkler may be of the open type, activated from a remote fire and/or smoke detector.

In accordance with the second aspect of the invention, the angles of the deflector, or more accurately its active surface, and the sprinkler orientation may be the same or may be different. The angle of the deflector with respect to the longitudinal axis, may be complementary to the angle at which the longitudinal axis is inclined to the vertical face, so that in the installed position of the sprinkler at least part of the deflector is horizontal, or substantially so.

In a preferred embodiment in accordance with the second aspect of the invention, the sprinkler is mounted at an angle of 45° to the horizontal face, particularly for a sprinkler with a deflector inclined at an angle of 45° to the longitudinal axis, which would locate the active surface horizontal, i.e. parallel to a ceiling or floor. The mounting of the sprinkler at the desired angle to the vertical face may be achieved simply by incorporating the sprinkler in a cornice angled across a corner of a room formed between a

5 wall (providing the vertical face) and ceiling. Alternatively, the sprinkler and in particular its body member may have an attachment which enables it to be mounted directly in a wall with the longitudinal axis of the sprinkler inclined at the desired angle to the vertical face. Similarly, the sprinkler may be adapted for mounting in a ceiling, with its outlet at the desired angle. Whichever mounting is employed, the fact that the water column is deflected by the deflector through an angle substantially less than 90° ensures that sufficient energy remains in the deflected spray or jet to project an extensive spray pattern.

15 The sprinkler according to the invention has an angled deflector which can be of simple and robust construction compared with known sprinklers having deflectors. The sprinkler may produce a satisfactorily uniform distribution of water over a substantial area extending in all directions on one side of the installed position of the sprinkler.

20 The invention is illustrated, merely by way of examples, in the accompanying diagrammatic drawings, in which:-

Figure 1 is a schematic partly sectioned view of part of an enclosure fitted with a first embodiment of sprinkler according to the invention;

25 Figure 2 is a plan view of the sprinkler, one half of which is shown in a section taken in the plane marked II-II in Figure 1;

Figure 3 corresponds to Figure 1 but shows a second embodiment; and

Figure 4 corresponds to Figure 1 but shows the second

embodiment.

In both embodiments, like components are accorded like reference numerals.

5 In the drawings, only one sprinkler 4 according to the first aspect of the invention is illustrated, although in practice a plurality of such sprinklers would be mounted at suitably spaced-apart locations to ensure adequate water coverage of the area to be protected, upon activation of the sprinkler.

10 Part of an enclosure such as a room in a building is shown having a wall 1 providing a vertical face and a ceiling 2. A cornice 3, which in this example consists of a flat plate, is fitted in a corner defined between the wall 1 and ceiling 2, the cornice 3 lying in a plane inclined at 45° to
15 the wall 1 and ceiling 2, that is, at 45° to the horizontal, and in accordance with the second aspect of the invention, sprinklers 4 are mounted at predetermined intervals along the length of the cornice 3. In a relatively small room of course a single sprinkler 4 may suffice and may be located at
20 the mid-length of the cornice 3.

In detail, each sprinkler 4 has a body member 5 having a longitudinal axis X-X. The body member 5 has a screw-threaded spigot 6 for water-tight attachment of the sprinkler 4 to a screw-threaded socket 7 of a "T"-fitting 8 of a water
25 supply pipe 9 extending along the cavity bounded by the wall 1, the ceiling 2 and the cornice 3.

In the embodiment of Figures 1 and 2, the sprinkler 4 is of a locally activated kind, the body member 5 incorporating a temperature sensitive element, in this

example a fluid filled, frangible glass bulb 10, which via an interposed cup-like metallic valve member 11, seats against an annular valve seat 12 surrounding a water discharge orifice 13, normally closed by the valve member 11, at a terminal end of a water supply bore 14, and thereby confining water within the water supply bore 14, the latter communicating with the supply pipe 9, and the axis of the water supply bore 14 coinciding with the longitudinal axis X-X of the body member 5. The sprinkler 4 is activated when expansion of the

fluid within the glass bulb 10 shatters the bulb upon a predetermined ambient threshold temperature occurring, with water pressure in the supply pipe 9 and the supply bore 14 then unseating the valve member 11 thereby opening the discharge orifice 13 and allowing a water column to exit through the latter along the axis X-X.

In the mounted position of the sprinkler 4 the X-X axis, is perpendicular to the plane of the cornice 3, and therefore inclined at 45° to the horizontal.

In the embodiment of Figures 3 and 4, the sprinkler 4 is of a remotely operated kind, no frangible glass bulb and valve member being present, so that the water discharge orifice 11 is open and until activation occurs, no water is present in the water supply bore 14 or supply pipe 9. Activation is controlled by a remotely located temperature and/or smoke detector (not shown) capable of operating a solenoid valve (not shown) to admit water to the supply pipe 9 and hence supply bore 14.

With both embodiments support means in the form of two arms 15 extend from the body member 5, projecting beyond the

water discharge orifice 13, and adjacent their terminal ends distal from the body member 5 are provided with a top boss 16 interconnecting the two arms 15. The top boss 16 is, in the embodiment of Figures 1 and 2, provided with a hole to receive a pin 17 and nut around which pin 17 the top boss 16 is subsequently crimped, and in the embodiment of Figures 3 and 4 by a screw 17A fitting into a tapped hole in the top boss 16, and a plate-like deflector 18 is secured to the arms 15 by the pin 17 and its nut, and the screw 17A in the first and second embodiments respectively.

The deflector 18 has a major active surface 19 located in the path of the emerging water column and hence intersecting the X-X axis, with the area of the active surface 19 being substantially greater than the cross-sectional area of the water discharge orifice 13. The deflector 18 in this example has its active surface 19 in a plane inclined at an angle of 135° to the axis X-X of the sprinkler body member 5, in the direction of impingement of the water column, so that the latter is deflected by the active surface 19 through an acute angle, in this case 45° . Water deflectors where the included angle between the active surface 19 and the water column is at an angle other than 135° , but not 90° or 180° may be employed. A front edge 20 of the deflector 18 is substantially semi-circular and formed with a number of radial slots 21, to define tines 22 and a forward edge portion 23 of each tine is directed slightly upwardly relative to the active surface 19. A rear edge 24 of the deflector 18 has an upwardly-turned lip 25 on the other side of the X-X axis from the front edge 20 to prevent the dispersal of water towards

the wall 1 upon activation of the sprinkler 4.

If the body member 5 is mounted in a wall or ceiling so that the X-X axis is inclined at an angle of 45° to the vertical, the deflector 18 would normally be arranged so that it deflects the water column through an angle of 90° , that is, in the installed position the deflector 18 is substantially horizontal, as shown in Figures 1 and 3.

The water column issuing from the discharge orifice 13 when the sprinkler 4 is activated impinges upon the active surface 19 of the deflector 18 and is deflected into a substantially horizontal direction, without excessive energy loss, breaking up into droplets. The droplets are thus directed into the enclosure from the sprinkler 4 and hence away from the wall 1 adjacent which the sprinkler 4 is mounted, the deflector 18 illustrated in the drawings producing a paraboloidal spray pattern. Because of the relatively low energy loss the spray pattern extends a substantial distance into the enclosure, typically 5-15 metres, and also spreads for a comparable distance laterally on each side of the sprinkler 4.

It will be understood that the sprinkler 4 in accordance with Figures 1 and 2 could utilise any suitable form of temperature-sensitive element to effect activation for fire control/extinguishing, or could even be of a so-called life safety type requiring a faster response rate than a conventional fire protection sprinkler. For example, the sprinkler could incorporate a "memory metal" activation device capable of fast response to fires and at a greater distance from the sprinkler than conventional liquid-filled sprinkler

bulbs.

In alternative fixing arrangements the sprinkler 4 may be mounted with its deflector 18 inclined to the horizontal. The angle of inclination of the deflector 18 to the X-X axis
5 may be selected according to the desired throw pattern. Similarly, the deflector 18 may have a variety of edge profiles.

CLAIMS

1. A fire protection sprinkler comprising:-

(a) a body member having a longitudinal axis;

(b) a water supply bore extending through the body member, co-axial with the longitudinal axis thereof and terminating at a water discharge orifice;

(c) support means extending from the body member to carry a deflector at a location spaced from the discharge orifice; and

(d) the deflector secured to the support means at an angle greater than 90° and less than 180° with respect to the longitudinal axis of the body member, such that an active surface of the deflector, upon activation of the sprinkler, is struck by a water column emerging from the discharge orifice.

2. A sprinkler as claimed in Claim 1, wherein the deflector is plate-like.

3. A sprinkler as claimed in Claim 1 or Claim 2, wherein the deflector is inclined to the longitudinal axis of the sprinkler at such an angle that, upon activation of the sprinkler, the water column emitted from the water discharge orifice and impinging on the deflector is deflected through an angle of less than 90° .

4. A sprinkler as claimed in Claim 3, wherein the deflector is inclined with respect to the longitudinal axis to deflect water through an angle of 45° .

5. A sprinkler as claimed in any preceding Claim, wherein the area of the active surface of the deflector is greater than the cross-sectional area of the water discharge orifice.

6. A sprinkler as claimed in any preceding Claim, wherein the deflector is a separate component attached to the body member.

7. A sprinkler as claimed in any one of Claims 1 to 5, wherein the deflector is an integral element of the body member.

8. A sprinkler as claimed in any preceding Claim, wherein the deflector has a front edge over which the deflected water spray or jet flows upon activation of the sprinkler and an upwardly-turned lip at a rear edge of the deflector opposite the front edge to restrain water flow or spray rearwardly of the deflector.

9. A sprinkler as claimed in any preceding Claim, die cast in brass or other alloy with the deflector not vulnerable to impact deformation when subjected to impact forces below 220N.

10. A sprinkler as claimed in any preceding Claim, fitted with a heat sensitive element.

11. A sprinkler as claimed in any one of Claims 1 to 9, having an open water outlet orifice.

12. A sprinkler substantially as hereinbefore described with reference to Figures 1 and 2 of the accompanying drawings.

13. A sprinkler substantially as hereinbefore described with reference to Figures 3 and 4 of th

accompanying drawings.

14. A fire protection sprinkler installation comprising a sprinkler as defined in any preceding Claim mounted at an elevated location in or on a structure having a vertical face in such a disposition that the sprinkler is
5 generally downwardly or upwardly directed, at an angle less than 90° and greater than 0° with respect to the vertical face of the structure.

15. An installation as claimed in Claim 14, wherein the structure is a wall, gallery or walkway edge.

16. As installation as claimed in Claim 14 or 15, wherein the deflector angle, with respect to the longitudinal axis, is the same as the sprinkler orientation angle, with respect to the vertical face.

17. An installation as claimed in Claim 14 or 15, wherein the deflector angle, with respect to the longitudinal axis, is different to the sprinkler orientation angle, with respect to the vertical face.

18. An installation as claimed in Claim 16, wherein, in the installed position of the sprinkler, at least part of the deflector is horizontal, or substantially so.

19. An installation as claimed in any one of Claims 14 to 18, wherein the sprinkler is mounted at an angle of 45° to the vertical face.

20. An installation as claimed in Claim 19, wherein the deflector is inclined at an angle of 45° to the longitudinal axis.

21. An installation as claimed in any one of Claims 14 to 20, wherein the mounting of the sprinkler at the desired

angle to the vertical face is achieved by incorporating the sprinkler in a cornice angled across a corner of a room formed between a wall (providing the vertical face) and a ceiling.

22. An installation as claimed in any one of Claims 14 to 20, wherein the mounting of the sprinkler at the desired angle to the vertical face is achieved by the sprinkler and in particular its body member having an attachment which enables
5 it to be mounted directly in a wall with a longitudinal axis inclined at the desired angle to the vertical face.

23. An installation substantially as hereinbefore described with reference to Figures 1 and 2 of the accompanying drawings.

24. An installation substantially as hereinbefore described with reference to Figures 3 and 4 of the accompanying drawings.